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## (54) Cementitious Products for Road-Making

(57) A self-binding or cementitious material for road-making comprises a mixture of finely divided pozzolana or a quenched blast furnace slag, together with steel making slag, and an aggregate filler material, and water.

The pozzolana may comprise a volcanic tuff or trass, burnt clay, PFA or burnt oil shale.

The aggregate filler material may comprise a gravel or crushed granite material.

The material may also include small amounts of a chemical reaction activator such as slaked lime or gypsum.

**SPECIFICATION****Implements in or Relating to Cementitious Products**

This invention relates to the production of 5 cementitious products. More particularly, although not exclusively, the invention is concerned with materials for use in the underlayers of road structures.

It is customary to classify road, (or "pavement") 10 as it is sometimes called) construction into two types. These are known essentially as the flexible form and the rigid form of construction. Both types are constructed in layers, and these layers often need to be internally bound together or 15 otherwise stabilised. This binding or stabilisation is usually brought about by the inclusion of an appropriate cement or a tar or bitumen product.

In the flexible type of road construction, generally three layers are provided, these being 20 commonly called the surfacing, the road-base and the sub-base. The surfacing is usually a bitumen or tar bound material, the road-base may be bitumen or tar bound or may be cement bound, and the sub-base may at times be cement bound.

25 Technical specifications for both the cement-bound road-base and sub-base materials are invariably provided by the road making authorities and are usually classified as "soil cement", "cement bound granular material" or "lean concrete".

30 The rigid type of road construction usually consists of a concrete slab on a sub-base layer. The slab will again be in accordance with a pre-determined technical specification and is 35 generally of a type referred to as "pavement quality concrete".

It is an object of the present invention to provide a convenient and inexpensive material capable of meeting the required specifications for 40 road-base and sub-base materials in flexible types of road construction, and for the pavement quality concrete in rigid road constructions.

In accordance with the invention there is 45 provided a self binding or cementitious composite material comprising a mixture of a finely divided pozzolana or a quenched blast furnace slag together with steel making slag, and an aggregate filler material, and water.

The composite material may include small 50 amounts of chemical reaction activators such as slaked lime, gypsum, or other suitable material. We have found that, when mixed in the appropriate proportions, and compacted, the material as herein defined develops strength 55 sufficient to meet one or other of the above-mentioned technical specifications.

By the expression "pozzolana" as used herein 60 we mean natural or artificial materials which, though not cementitious in themselves, contain constituents which will combine with lime at ordinary temperatures in the presence of water to form stable insoluble compounds possessing cementitious properties. Natural examples of a pozzolana include volcanic tuffs and trass whilst

65 artificial examples of pozzolana include burnt clay, pulverised fuel ash, and burnt oil shale.

By the expression "steel making slag" as used herein is meant a non-metallic by-product of any batch steel-making process. Thus it is formed by 70 the combination of lime with impurities from the steelmaking iron, surplus steelmaking additives and debris from the refractory lining of the steelmaking vessel. The material comprises a crystalline solid constituted mainly by silicates, 75 iron oxides and variable quantities of uncombined lime.

The aggregate filler material may comprise a gravel or crushed granite material or any other natural or synthetic rock.

80 In one example a self binding material according to the invention comprises 10% by volume pulverised fuel ash together with 33% by volume basic oxygen steelmaking slag and 57% by volume aggregate and water. This material 85 was found to have a compressive strength of 10 MN/mm<sup>2</sup> after 7 days and 20 MN/mm<sup>2</sup> after 28 days. It will be appreciated that the proportion of this example can be adjusted in order to provide a range of strengths from the low 90 requirement for "soil cement" specifications to the considerably high requirement for "pavement quality concrete".

In a second example a combined material according to the invention comprised 15% by 95 volume pelletised blast furnace slag together with 28% by volume basic oxygen steel making slag and 57% by volume aggregate together with water and 0.4% by volume of slaked lime plus 0.8% by volume calcium sulphate serving as 100 chemical activators. This material had a compressive strength of 5 MN/mm<sup>2</sup> after 30 days and 6.5 MN/mm<sup>2</sup> after 60 days. In the case of this example the 7 day strength requirement of technical specifications was met at a later age, 105 but the material was found to be initially stable due to the compaction and mechanical interlocking of its constituents.

In addition to providing a material of 110 satisfactory strength the use of a pozzolana such as pulverised fuel ash or a quenched blast furnace slag with steel making slag removes or at least substantially reduces in this material due to its inclusion of uncombined free lime.

**CLAIMS**

115 1. A self binding or cementitious composite material comprising a mixture of finely divided pozzolana or a quenched blast furnace slag together with steel making slag, and an aggregate filler material, and water.

120 2. A material as claimed in claim 1 including small amounts of a chemical reaction activator.

125 3. A material as claimed in claim 2 wherein the activator is slaked lime or gypsum.

4. A material as claimed in any one of the preceding claims wherein the pozzolana comprises a volcanic tuff or trass.

5. A material as claimed in any one of claims 1

to 3 wherein the pozzolana comprises burnt clay, pulverised fuel ash, or burnt oil shale.

6. A material as claimed in any one of the preceding claims wherein the aggregate filler material comprises a gravel or crushed granite material.

7. A self binding or cementitious composite material comprising a mixture of water, an aggregate filler material and steel making slag.

10 together with finely divided pozzolana or a quenched blast furnace slag such as to reduce the potential volumetric instability which could otherwise be present because of its inclusion of uncombined free lime.

15 8. A self binding or cementitious composite material substantially as described in the first or second example hereof.

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